

Midterm Exam

Level: 1st Year

Material: Algorithms and Static Data Structures

Date: 27/11/2024

Duration: 1h30

Exercise 1: Swapping (06 points)

Write an algorithm that carries out a swapping of an integer number n ; i.e. that exchanges the high-weight digit with the low-weight digit of an integer number.

Example

- Input:

- ☐ $n = 5961$ ----->
- ☐ $n = -18$ ----->
- ☐ $n = 723859$ ----->
- ☐ $n = 9$ ----->

- Output:

- ☐ 1965
- ☐ -81
- ☐ 923857
- ☐ 9

1960

960

Requirements

- Perform a detailed analysis with input, output, and main steps.
- Develop an algorithm that handles the swapping.
- Validate the algorithm using the first two example numbers to ensure its correctness.

Exercise 2: Digit Frequency Counter (07 points)

Write an algorithm that reads an integer number n and counts the frequency of each digit (0...9) in the number using **one (01) counter only**.

Example

- Input:

- ☐ $n = 122333$

- Output:

- ☐ Digit 1: 1 time(s)
- ☐ Digit 2: 2 time(s)
- ☐ Digit 3: 3 time(s)

- Input:

- ☐ $n = 58568$

- Output:

- ☐ Digit 5: 2 time(s)
- ☐ Digit 6: 1 time(s)
- ☐ Digit 8: 2 time(s)

Exercise 3: Exponential approximation (07 points)

Write an algorithm that calculates the approximation of e^n with t terms, where t is a positive integer number using **one (01) loop only**.

$$e^n = 1 + \frac{n^1}{1!} + \frac{n^2}{2!} + \frac{n^3}{3!} + \frac{n^4}{4!} + \dots + \frac{n^t}{t!}$$